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KEY FINDINGS AND ISSUES

- Environmental and resource issues are critically linked to future urban growth patterns and the supporting transportation systems that growth requires. Growth can be enabled by the availability of resources or constrained by environmental and resource limitations. The purpose of this issue paper is to highlight some specific impacts of urbanization on the natural and human environment and on the resources necessary to support it.

- The "Brown Cloud" over Metropolitan Phoenix is a daily visible reminder of the need to improve air quality in the region. Efforts to reduce vehicle miles traveled and continued progress in reducing vehicle emissions is critical to improving air quality. What role can the transportation plan play in encouraging trip and mileage reduction? In the face of increasing population and automobile usage, how can the transportation system contribute to regional efforts to improve air quality? What transportation systems and modes would be most effective in alleviating air pollution? How can these systems be encouraged or implemented?

- While there is an adequate water supply in the region for the near-term, water is ultimately a finite resource. New water planning and management legislation that is linked to regional and local land use and transportation planning is necessary to maintain an adequate water supply in the future. How can transportation planning efforts be better coordinated with land use planning and water planning and management? Can a coordinated effort be realized? How can the transportation network promote water conservation (e.g., xeriscaping along road networks) and be sensitive to growth-related water resources?

- The quality of the region's water supply is potentially vulnerable to deterioration through over-consumption of groundwater and contamination of water sources. How can transportation planning help ensure water quality in the region? How can the transportation network be designed to respond to issues of surface runoff and pollutants generated by the urban system?

- The Sonoran Desert and open spaces in and around the region are a valuable resource, which will become even more valuable with the high rate of urban growth in the region. How can future development of the transportation network facilitate land, vegetation and animal preservation efforts? Can transportation planning influence changes in how State Trust lands are converted for urban use or open space? What access requirements would need to be in place to facilitate equal and fair access to open spaces?

- Progress in implementing renewable and environmentally sound energy sources and practices in the region should continue to be encouraged. Can transportation

systems (e.g., street illumination) capitalize on renewable energy sources? How can the transportation plan promote the development of renewable energy technologies? What role should alternative-fuel vehicles and new automobile technology play?

- Quality of life supports urban vitality by attracting and retaining workers. There are indications that the Maricopa Association of Governments (MAG) region may not be doing enough to preserve and increase recreational, social and cultural opportunities. How can the transportation network facilitate access to these important resources? Can the quality of life in the MAG region be improved through ramifications of the transportation plan? What are the potential negative or positive consequences of future transportation systems for the quality of life?

- Environmental justice concerns are typically associated with locations that have high concentrations of minority or poor populations and high concentrations of significant environmental hazards. Great care must be taken to design and construct transportation projects so that they do not result in disproportionate exposure of poor and minority communities to environmental hazards. How can transportation projects be implemented while minimizing negative environmental justice effects on legally protected population groups? Can major transportation infrastructure projects be designed to integrate poor and minority communities rather than divide and isolate them? Will transit development be tied to good land use planning, so that it stimulates urban renewal and economic development in neighborhoods with substantial poor and minority populations?

THE NATURAL ENVIRONMENT

Air Quality

- **National Findings:** Air pollution in major cities across the United States is a public health concern and is linked with global climate changes. While per-vehicle emissions that contribute substantially to air pollution have steadily declined through advances in technology and stricter regulations, the vehicle miles traveled annually continues to grow rapidly. Efforts to decrease vehicle miles traveled, along with continued progress in emission controls, are necessary to significantly improve air quality.

  - Air pollution associated with motor vehicles is the most widely recognized and studied environmental impact of transportation. Air pollution is generated predominantly as a by-product of the combustion of motor fuels from vehicle travel, but also from highway construction, fugitive dust stirred by road travel and emissions from refrigerant agents from vehicle air conditioning units.[1]

  - The increasing number of vehicle miles traveled could offset air quality gains from a steady reduction in per-vehicle emissions since the 1960s. A contemporary passenger car emits 60% to 90% less pollution over its lifetime than its 1970 counterpart. However, the average annual mileage driven per vehicle in 1995 (9,567 miles) is nearly twice as high as in 1970 (4,587 miles) and continues to grow. Between 1980 and 1997, the annual growth of total vehicle miles traveled exceeded population growth by over 2% annually. People are making longer and more frequent trips today than they did 20 years ago.[2,3]

  - The Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) that cover six "criteria pollutants." Motor vehicles emit three of these pollutants: carbon monoxide (CO), nitrogen oxides (NO_x), and volatile organic compounds (VOC), which together account for between 30% and 60% of all air pollutants emitted.[3]

  - Based on ozone monitoring data collected by the EPA, air quality across the country continues to be a major threat to public health and appears to be worsening in some areas. Major trends highlighted by the American Lung Association include evidence that no region is immune, and that both large and small cities are afflicted.[4]

  - Air pollutants exacerbate and contribute to several health problems. A 1991 study concluded that motor vehicle pollution was in part responsible for 50 to 70 million respiratory-related restricted activity days, 852 million headaches

from CO, and as many as 40,000 premature deaths in the United States annually.[3]

- In 1998, transportation sources accounted for approximately 31% of total U.S. emissions of carbon dioxide (CO_2), a greenhouse gas. Greenhouse gasses are linked to global climate changes and global warming, which may result in more volatile weather patterns.[2]

- **Regional Findings:** The MAG region has the worst air quality in the state, and the Phoenix Metropolitan Area is among the 20 worst metropolitan areas in the United States. There is widespread concern among residents of the region over the visible haze or "Brown Cloud" that is prevalent in the fall and winter, hovering over the metro area. While the region has exhibited limited progress in reducing some pollutants, the "Brown Cloud" itself (composed mainly of particulate matter) appears to be worsening.

  - Maricopa County, compared to the other counties in Arizona, had the highest number of high ozone days in the "unhealthy" range from 1996 to 1998, based on EPA standards. The Phoenix-Mesa Metropolitan Statistical Area (MSA) ranks 19th among the 25 most ozone-polluted cities in the United States.[4]

  - Citizens are increasingly concerned about air quality, visibility and health effects of the "Brown Cloud" that sits over the Phoenix Metropolitan Area. Over 6,000 people reviewed the draft report of the Governor's Brown Cloud Summit, and 600 people submitted more than 1,000 comments. This level of response far exceeds the public participation in any previous regional air quality task force, and signals growing concern among residents.[5]

  - The "Brown Cloud" appears to be worsening. Measurements show that on the dirtiest days, during the fall and winter, the "Brown Cloud" has become 10% worse from 1994 to 1998. The cleanest days, during the spring and summer, have become 64% worse over the same period.[5]

  - Combustion sources contribute over 65% of the $PM_{2.5}$ (particulate matter with a diameter of less than 2.5 micrometers) that causes the "Brown Cloud." These combustion sources are predominantly mobile exhaust from gasoline and diesel engines.[6]

  - According to the Centers for Disease Control and Prevention, 316,000 people in Arizona have asthma, a 158% increase from 1980 to 1998. Similar increases have occurred across the United States. While air pollution is not the only trigger for asthma, it does magnify its symptoms. The Phoenix area was once considered a haven for breathing problems, but with its "Brown Cloud"

and prolific pollens, it no longer provides a clean air solace for asthma sufferers.[7]

- The region is categorized by the EPA as a moderate or serious non-attainment area for three pollutants: carbon monoxide (CO), ozone (O_3) and particulate matter. Litigation at the Supreme Court will determine whether the EPA's proposed stricter 8-hour ozone measurement can be used instead of the existing 1-hour standard. If the courts permit the 8-hour measurement, attainment of the new standard under current attainment plans will be much more difficult. Continued non-attainment can lead to the withholding of federal funds for highway projects.

Water Quality

- **National and Regional Findings:** Potential water quality deterioration affects both surface water and groundwater. Impervious urban surfaces such as roads and parking lots increase both the volume and rate of surface runoff and act as a conduit for a wide variety of toxic pollutants. During storms, rainwater washes out atmospheric pollutants, picks up roadway deposits and runs off into receiving water bodies.[1] In the MAG region, continued overdraft (defined below) of the groundwater may cause deterioration in water quality, either through surface water contamination via earth fissures or through pumping of water from deeper in the aquifers that are less pure.

  - Water quality issues related to transportation are inherently tied to broader issues of urban growth and sprawl. While the expansion of urbanized areas into natural landscapes will undoubtedly require expanded transportation systems, the impact of transportation on water quality separate from other urban systems is difficult to quantify. These impacts are typically described in terms of the urban system as a whole.

  - Arsenic is a naturally occurring chemical element in rock and soil and is present in trace amounts in groundwater. Due to Arizona's geology and because a portion of the potable water supply is from groundwater, arsenic in drinking water is a significant problem. The EPA believes that arsenic toxicity at 5 to 50 ppb in water, a common level in Arizona well water, is significant and potentially hazardous. Reduction to 5 ppb will require remediation or result in closure of many Arizona wells, with likely significant increase in the cost of water to many consumers. Treating drinking water to reduce or eliminate arsenic is expensive and will create significant problems for smaller, poor communities.[8]

  - Overdraft describes a condition where the water level in an aquifer is lowered, as groundwater is extracted more rapidly than it is replaced, which may lead

to land subsidence and earth fissures. Land subsidence is a drop in elevation of the land as the sediments in the de-watered aquifer become compressed. Earth fissures, which are long and narrow tension cracks, are associated with land subsidence, and if deep enough to extend to the water table, can permit contaminated surface runoff to enter the aquifer directly. Prediction of where subsidence and fissures may occur is difficult.[9]

- Subsidence and fissures have occurred throughout the MAG region. Areas of disturbance include Queen Creek, Mesa, Apache Junction, Paradise Valley, Scottsdale and an area outside Luke Air Force Base. Damage to sewer systems, building foundations and structures, dams and flood control channels have been documented. Overdraft also forces water to be pumped from greater depths. This water tends to be less pure as it contains more salts and minerals.[9,10]

- Stormwater controls associated with road construction can significantly impact downstream natural drainage features, riparian vegetation and wildlife habitat. While federal and state regulations are in place to mitigate construction impacts on stormwater, increased monitoring and enforcement may be required in order to ensure that construction sites comply with regulations designed to minimized environmental hazards.

Ecology and the Sonoran Desert

- **National and Regional Findings:** Urbanization interacts with global change in important ways and plays a central role in alteration of global biogeochemical cycles, changes in biodiversity due to habitat fragmentation, and changes in land use far beyond the city's boundaries. In the MAG region, the specific impacts of urbanization on the ecological conditions of the city and the surrounding environment are being studied by the federally funded Central Arizona – Phoenix Long Term Ecological Research (CAP LTER) Project at Arizona State University. The ongoing monitoring and research activities of CAP LTER will provide valuable ecological insight on the impact of the region's growth.[11]

  - Urbanization has detrimental effects on wildlife habitats. Not only does development displace wildlife, but it also fragments or separates habitats and isolates species from breeding and feeding grounds. Only hardy species can survive the changes in their environment brought about by human occupation. The diversity of wildlife in the area is reduced to a limited group of birds and small animals that can adapt.[12]

  - A plant community survey of desert plant communities in desert remnant patches shows that plant communities have been affected by the urban fragmentation of the former continuous expanse of native Sonoran Desert.

This survey conducted by CAP LTER repeats one completed 20 years ago. Results indicate that the scale of environmental heterogeneity in these habitats is very small compared with that of other biomes.[11]

- The Sierra Club has ranked the Phoenix Metropolitan Area as the third most sprawl-threatened city in the United States, behind Los Angeles and San Diego. Sprawl threatens the Sonoran desert habitats that have taken thousands of years to develop. For example, the rapid expansion of the northeastern Phoenix area is running into the Arizona Uplands Division of the Sonoran Desert. This biologically diverse portion of the desert is home to more than 2,500 plant species and many kinds of rare desert animals.[13]

- The urban "heat island" effect of mass paving has pushed nighttime low temperatures in the urban area eight degrees Fahrenheit higher than 50 years ago, which poses a significant impact on a desert climate's livability.[14] A study by CAP LTER has indicated a substantial heating increase of 10 degrees Celsius since 1985. The urban "heat island" effect and the urban fringe represent a boundary of well-defined discontinuity in microclimate.[11] While xeriscaping is a logical solution to water conservation, an unintended consequence of the change from water intensive landscaping is it reduces temperatures through shade and evaporation, moderating in part the heat gains through paving.

THE HUMAN/SOCIAL/CULTURAL ENVIRONMENT

Environmental Justice

- **National Findings:** Environmental justice seeks to ensure that all people, regardless of race, national origin or income, are protected from disproportionate impacts of environmental hazards. Great care must be taken to design and construct transportation projects so that they do not result in disproportionate exposure of poor and minority communities to environmental hazards. There are several ongoing cases of environmental justice violations against transit authorities throughout the country, including a case in Atlanta, Georgia. If violations are proven in the judicial system, federal funding for transportation projects can be withheld or terminated.

  - Environmental Justice concerns are typically associated with locations that are characterized by both high concentrations of minority or poor populations and high concentrations of significant environmental hazards. Low-income and minority populations tend to be clustered in areas of low-cost housing, which are usually found in or near older central city locations. Older, heavy industries with requirements for low land values (e.g., scrap metal recycling, metal fabricating, chemical manufacturing, concrete batch mixing) also tend to

be located in or near central city areas that have not redeveloped. Transportation projects, whether roadways, structures or transit, often involve central city locations as well.

- The environmental justice movement culminated in Title VI of the Civil Rights Act of 1964, and related statutes, and in Executive Order 12898. This Executive Order, signed by President Clinton in 1994, underscores each federal agency's responsibility to ensure non-discrimination in projects that have federal funding.

- The goal of environmental justice is to ensure that all people, regardless of race, national origin or income, are protected from disproportionate human health and environmental impacts resulting from federal programs, plans and activities. While "disproportionate impacts" are not defined in the Executive Order, they typically occur when a location is characterized by both high concentrations of minority or poor populations and high concentrations of significant environmental hazards.

- In Maricopa County, one such location is zip code 85040 in southeast Phoenix. This location is an urban area with a large minority population, many children, rampant poverty, and an abundance of triggers — dust, pollen and air pollution — associated with industrial uses. Zip code 85040 is the Valley's worst place for children with asthma. In 1999, 74 children from this area were hospitalized for asthma, the most in the Valley, compared with northeast Mesa and central Scottsdale, which each had one child hospitalized for asthma.[7]

- With regard to transportation, poor or minority neighborhoods have historically experienced greater impacts from new regional highways than have other neighborhoods. Such impacts include displacement, noise and degraded air quality. Transit projects, as well, have often resulted in physical barriers that divide and isolate poor and minority neighborhoods, even as they provide increased access to improved transit systems. A striking example is the effect of Bay Area Rapid Transit (BART) on the poor and black neighborhoods of West Oakland, California.

- Poor and minority households seeking affordable housing outside of the central city are forced to move out to the edges of the urban area. The trade-offs for them include fewer transportation options, since the urban fringe has little or no bus service, and long commutes to employment centers and social support services.

Historic and Archaeological Sites

- **National and Regional Findings:** The Federal government preserves historic and prehistoric resources in partnership with state and local agencies, Indian communities and private organizations and individuals, as mandated by the National Historic Preservation Act of 1966 (amended in 1980 and 1992). The Secretary of the Interior is authorized to maintain a National Register of Historic Places composed of districts, sites, buildings, structures and objects significant in American history, architecture, archaeology, engineering and culture. Within Arizona, the State Historic Preservation Office (SHPO) is responsible for the identification, evaluation and protection of Arizona's prehistoric and historic cultural resources, and assists private citizens, private institutions, local governments, tribes and state and federal agencies toward that end.

    - With a record of human habitation dating back at least 12,000 years, Arizona has a rich and varied cultural heritage, abundant in historical and archaeological resources.[15]

    - In Maricopa County, there are 26 Historic Districts encompassing 4,059 properties and 134 listings on the State and National Registers of Historic Places. The largest historical district in Arizona is the Coronado Residential Historic District in Phoenix, with 852 contributing properties.[15]

    - Close to 2,500 archaeological sites have been identified in Maricopa County in a survey performed for Maricopa County Parks and Recreation Department. Sites include Indian ruins, petroglyphs and pictographs, mines, agricultural fields, dams, quarries, ranches, canals, caves, cemeteries and ancient water systems.[16]

    - In Arizona, a multi-layered network covering all levels of government and both the public and private sectors is coordinated through the SHPO. This multi-layered network is crucial to the coordination and implementation of preservation projects in the state. Federal partners include the Advisory Council on Historic Preservation; Bureau of Indian Affairs; Federal Land Managing Agencies (including Bureau of Land Management, U.S. Forest Service, Bureau of Reclamation and Department of Defense); Federal Permitting Agencies; and the National Park Service. State government partners include the Archaeological Advisory Commission, Arizona Department of Commerce, Arizona Department of Transportation, Arizona Historical Society, Arizona State Land Department, Arizona State Museum, Arizona State Parks and Arizona's Universities and Colleges among others. Partnerships also include Tribal governments, national/state/local advocacy groups and county/local governments.[15]

Quality of Life/Social and Cultural Environment

(Refer to the New Economy Issue Paper for an expanded discussion on the Quality of Life)

- **Regional Findings**: Quality of life is important to urban vitality, in part because it helps to attract and retain workers in the New Economy. Research on business relocations has identified quality of life as a key factor in the location decisions of CEOs of high-tech firms. This is because quality of life amenities have proven to be critical to the recruitment and retention of upper-level managers, and because highly skilled workers in these industries are also drawn to communities with these amenities. While Maricopa County has significant recreational opportunities, it appears to be doing too little to preserve and increase these opportunities. Furthermore, the relatively low ranking of arts, cultural and recreational amenities compared with peer cities could signal a growing decline in the ability to attract workers to the region.

    - During the period from 1997 to 1999, Maricopa County residents who were surveyed consistently identified education, families and youth and public safety and crime as the most important quality of life categories. Compared with other western U.S. metropolitan regions, Maricopa County had somewhat more affordable housing and an average cost of living, as well as the highest property crime rate, the lowest per capita personal income, and the least miles of transit service per resident. While crime is declining in the region, personal safety and crime was reported as the most important quality of life indicator in 1999.[17]

    - In 1999, nearly three out of four residents of Maricopa County surveyed indicated that the region's population is growing too fast, and only 5% stated that the region is doing a good job of preserving the desert. If given an opportunity to move out of the region tomorrow, 45% of the region's residents would do so. Their top three reasons were that there are too many people, the climate is too hot and they are concerned about crime.[17]

    - The quality and availability of arts, culture and recreational amenities was ranked ninth by Maricopa County residents in a survey of factors affecting regional quality of life. Two percent (2%) of those surveyed cited these amenities as the single most important factor. Earnings and contributions to non-profit arts and cultural institutions increased by 40% during the period 1996-97 to 1998-99, while attendance increased by 30%. This equates to increases of approximately 23% in per capita earnings and contributions, and 15% in per capita attendance. During the period 1996 to 1998, attendance at professional sporting events increased by 85% (due to the inception of the

Arizona Diamondbacks), representing a 63% increase in per capita attendance.[14]

REGIONAL RESOURCES

Water Resources

- **Regional Findings:** For the region, water is ultimately a finite resource but the current supply is ample. According to current projections in the Third Management Plan (defined below), the MAG region will not meet conservation goals for the year 2025. This necessitates more strategic water planning and management efforts that are specifically linked to regional and local land use and transportation planning. When the Governor's Water Management Commission concludes its report in December 2001, it will be recommending actions that will shape future water planning and management legislation.

  - While the current water supply for the region is ample, it is a fixed resource, and water management will become increasingly important, since there are no potential projects similar in scope or scale to the Central Arizona Project to increase the future water supply. An increasing connection between water management and land use planning, which will ultimately relate closely to transportation planning, is necessary.[14,9]

  - Growth in the region will be forced to balance the escalating costs of providing water against the public outrage at increasing water prices. Water consumers in Arizona have never paid the full cost of consumption since the SRP and CAP were federally subsidized projects. These projects have kept water prices to the consumer low, but as demand on these sources grows, the consumer will likely need to bear the costs of any future water development. Some cities in the region have already instituted rate increases, and other cities are in the process of reviewing their water rate structures.

  - Unused Native American water rights may be a partial solution for uncertain water supplies and budgets in the future. In particular, negotiations have been under way to obtain a portion of the water rights of the Gila River Indian Community for use by the Phoenix Metropolitan Area.[9,18] These Native American water rights represent a wild card since areas once assumed to not be developable due to the lack of water resources could be developed with water rights leased from the Indian communities. However, this could increase the vulnerability of environmentally sensitive desert areas to development, and contribute to a geographical disconnect between availability and use of water resources (see below).

- Water availability is not equally dispersed throughout the region. Not all parcels of land have uniform access to water sources but land use, transportation and water planning have acted as if that were not true. An example is the Anthem Master Planned Community by Del Webb, located north of Phoenix. In order to develop Anthem, CAP water rights have been leased from the Ak-Chin Indian Community, which is located 30 miles south of Phoenix. This geographical disconnect in terms of water rights and supply may be a future concern to water supply management.

- The Governor's Water Management Commission has been charged to recommend legislative actions that will update existing water management legislation such as the 1980 Groundwater Management Act. The Arizona Municipal Water Users Association has requested that the State Legislature refrain from considering any major water legislation until the 2002 legislative session, when the final recommendations of the Water Management Commission will have been completed.[19,20]

- The Phoenix Active Management Area (AMA), which follows groundwater basins and sub-basins rather than jurisdictional boundaries, was established along with four other management areas in major urban areas of the state by the 1980 Arizona Groundwater Management Code to protect specific areas with severe groundwater overdraft.[9]

- Groundwater overdraft in the Phoenix AMA is currently at 360,019 acre-feet per year. Based on the current projections of water supply and demand, the Phoenix AMA will not meet its mandated safe-yield goal by the year 2025. The safe-yield goal was established by the Groundwater Management Act and specifies that by 2025 more groundwater cannot be taken out than replaced.[9]

- As required by the 1980 Groundwater Management Act, the Phoenix AMA completed the Third Management Act in December 1999. Among its recommendations is a need for more localized water management due to divergent water use patterns and groundwater conditions within the Phoenix AMA.[9]

Energy Resources

- **Regional Findings:** Retail competition for electricity in Arizona is not expected to lead to energy problems similar to those recently experienced in California, but interstate competition for power may increase consumer costs. However, continued efforts to develop and expand solar power generation, taking advantage of the abundance of sunlight in Arizona and the development of other renewable energy resources, can place the region at the forefront of energy progress. Development of responsible programs that encourage alternative-fuel

vehicle options should not allow past failures or controversies to hinder energy progress.

- The power crisis that affected California in December 2000 and January 2001 is not expected to affect Arizona. While there are many explanations as to the cause of California's crisis, some of them contentious, the present situation in Arizona has some clear differences from the events in California.[21]

  – One difference is the absence of generator and transmission line construction in California over the last decade. As the economy and demand in California grew, the capacity for power did not increase. According to the Arizona Public Service Company (APS), Phoenix area capacity in the year 2001 will most likely be adequate to meet demand. APS projections include a 1,500 megawatt increase in demand over the next ten years, with a more than matching increase in new capacity from six new generating units and the development of five major transmission line corridors.[21]

  – Another difference is that Arizona deregulation is more moderate than that of California and includes more consumer protections, such as price caps through the year 2004 and a competitive market system that allows power companies to sign long-term wholesale level contracts that reduce financial risks.[21,22]

- A capacity shortage on the pipelines that bring natural gas to Arizona is keeping prices high and could affect electricity generation. Without any developed natural gas wells, Arizona is completely dependant on transmission lines from Colorado, New Mexico and Texas. New electrical plants under construction are designed to use natural gas, which has lower air quality impacts than oil or coal fired plants. However, current regional gas transmission mains are at or near capacity. Lack of needed capacity could force a switch to oil or coal for new and existing electric generating plants with significant air quality impacts for the state and the region.[23]

- The alternative-fuel vehicle bill of 2000 and the subsequent multi-million dollar fiasco it created have most likely damaged public sentiment toward incentive programs for alternative fuels in the near-term. While the large numbers of people who intended to participate in the program may be indicative of the incentives that were offered, it also might suggest a genuine interest in more financially viable alternative fuel/vehicle options. A well-crafted program (without the loopholes and absence of budgetary safeguards in the 2000 alternative-fuel vehicle bill) could make a real difference in alternative fuel/vehicle usage in the future. However, if a significant switch to

alternative fuels becomes a reality, replacement revenue sources to offset the reduction in gas tax revenues should be considered.

- The Arizona Corporation Commission has required electric utilities to produce a portion of their power from solar energy, making Arizona the first state with such a requirement. The required solar energy portion is small, at just 0.55% of the total production by 2007. This requirement constitutes 50% of the 1.1% from renewable sources that will be required by 2007 (in progressively increasing increments starting in 2001). Utility companies with existing solar sources are reporting that demand for solar energy has outpaced supply, even with a surcharge to help offset the higher costs of solar generation over conventional non-renewable generation.[24] However, utility companies have historically been resistant to the development and implementation of alternative power sources and additional regulatory or incentive programs may be required to increase alternative energy research and development efforts.

Land Resources

- **Regional Findings:** Urban expansion is occurring in the MAG region at a high rate. Every effort should be made to conserve scenic and ecologically valuable open spaces within the region. State Trust lands surrounding the urban fringe that are managed by the Arizona State Lands Department (ASLD) could be prime candidates for open space conservation. The State Constitution and enabling legislation for ASLD may need to be updated to allow major conservation efforts, which are at odds with current ASLD mandates relative to revenue return to the state education trust.

  - Between 1975 to 1995, the urban area in the MAG region more than doubled, which amounts to almost 500 square miles of desert and agriculture that has been developed for urban purposes. Forty percent (40%) of all agricultural land and 32% of undeveloped desert was lost.[17]

  - The expansion of the urban fringe from 1990 to 1997 continues to occur at a high rate. A classic study of the urban fringe in Philadelphia in the first part of the 20th Century showed an outward rate of expansion at one mile per decade, but recent expansion in parts of Phoenix have occurred at a rate of one mile per year. In addition, there appears to be little or no time lag from the point when land is taken out of agriculture until it is used for housing and other urban purposes.[11]

  - The ASLD manages over 9.3 million aces of land, or roughly 13% of the state. Proposals have been made to protect some state-owned land near the Phoenix and Tucson Metropolitan Areas from urban development, including

an offer by Interior Secretary Babbitt, who proposed a land swap with the federal Bureau of Land Management.[25,26]

- As required by the State Constitution, the ASLD manages state-owned land to maximize revenues that support educational needs. Wholesale conservation of the land is not permitted, and to generate revenue, land sales or leases to developers will likely increase. Some of the state-owned lands are located at the urban fringe of the Phoenix Metropolitan Area and constitute an irreplaceable open space resource. Many believe that the State Constitution and federal enabling legislation should be amended so that the ASLD can play an active role in conservation while still generating revenues for the educational system.[17]

- A November 2000 State ballot measure, Proposition 100, would have protected up to 3% of State Trust land in a conservation reserve but was narrowly defeated. Many feel that even if the proposition had passed, it would have done too little in land conservation efforts. Talks have been under way between leading developers and conservationists regarding the protection of public lands, with a view toward new ballot measures for the 2002 elections.[27] However, smart growth initiatives are expected to face an uphill battle in a region where a significant portion of the local economy is driven by construction wages.

ABBREVIATIONS

AMA	Active Management Area
APS	Arizona Public Service Company
ASLD	Arizona State Lands Department
BART	Bay Area Rapid Transit
CAP LTER	Central Arizona-Phoenix Long Term Ecological Research
CO	carbon monoxide
CO_2	carbon dioxide
EPA	Environmental Protection Agency
O_3	ozone
MAG	Maricopa Association of Governments
MSA	Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standards
NO_x	nitrogen oxide
$PM_{2.5}$	Particulate matter pollutants under 2.5 microns in diameter
SHPO	State Historic Preservation Office
VOC	volatile organic compounds

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